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MANAGEMENT OF PINK BOLL WORM (*PECTINOPHORA GOSSYPIELLA SAUNDER*) BY BIO-AGENT OF (*BEAUVERIA BASSIANA*) ON COTTON CROP (*GOSSYPIUM HIRSUTUM L.*)

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ABSTRACT

The present investigation entitled "Management of pink bollworm (Pectinophora gossypiella S.) By bio-agent of Beauveria bassiana on cotton crop (Gossypium hirsutum L.)" cultivar i.e. Jaddoo was conducted during july to November, at Allahabad. The occurrence of pink boll worm (Pectinospora gossypiella) in 2015-2016 Kharif season. Field bioassay was conducted with percent of mortality pink bollworm (Pectinopora gossypiella) on cotton boll damage percent revealed that the maximum mortality per cent of Cypermethrin 25 %EC (69.34), followed by Beauveria bassiana 7% (69.42), Beauveria bassiana 6% (69.38), Beauveria bassiana 5% (67.02), Beauveria bassiana 4% (64.02), Beauveria bassiana 3% (60.39), Beauveria bassiana 2% (58.09), Beauveria bassiana 1% (54.34) as compared to control (14.44).

KEYWORDS: Beauveria bassiana, Pink Bollworm (Pectinophora Gossypiella), Mortality, Boll Damage and Cotton Crop

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Original Article

INTRODUCTION

Cotton, a major Economical crop of India, is considered as backbone of the national economy. It contributes about 1.4% to GDP and 6.9% of total value addition in agriculture. Export of cotton and textile products have a share of 57% in the overall exports of the country. Cotton scientific name (*Gossypium hirustum*) belongs to family Malvaceae. Cotton is unanimously designated as "King of fibres".

The cotton crop is attacked by a number of different insect pests and among them American boll worm caterpillar *Helicoverpa armigera* Hubner, tobacco caterpillar, *Spodoptera litura* Fabricius; Spotted bollworm *Earas vitella Fabricus*, Spiny bollworm *Erias insulana* Bosid, Red cotton bug Dydercus *cingulatus*, Dusky cotton bug *Oxycarenus hyalinipennis* stem weevil *Pempherulu* saffinis, White fly *Aleurodicus dispersus* are the pests of major importance (Atwal and Dhaliwal 2002).

Rossted flowers, interlocular burrowing, double seed formation discoloured lint and burrowed seeds cotton shows the infestation of Pink bollworm (*Pectinophora gossypiella* Saunders) causing above ETL level crossed *i.e* 1-2 larvae/ cottonboll. Pink bollworm is the key pest of cotton and requires regular control measures to produce a profitable crop. Now-a-days farmers mostly adopt chemicals for the effective management of cotton but indiscriminate use of pesticides is causing adverse effect on environment and developing insecticidal resistance in pests. So due to this reasons use of bio-agent will not harm to the environment and also be effective in controlling pest. So present experiment was conducted to evaluate *Beauveria bassiana* against pink bollworm.

Beauveria bassiana is a virulent, ubiquitous, entomopathogenic and hyphomycete fungus with a very wide range of insect pests (Tanada and Kaya, 1993). It is a resident of soil (Klingen *et al.* 2002) and has a

semelparous life history with a single reproductive episode. This entomopathogenic fungus is the most promosing group of biological control agent against insect pests (Lacey and Gottel, 1995) this virulent fungus initially infects and later releases all its infective propaguals (conidia) in a single spell after the death of the host insects (Barlett and Jaronski, 1988; Wraight *et al*., 2001). *B. bassiana* is able to penetrate into the host integument which completely encloses the host body within a chitinous cuticle and develops within the hemocoel. Successful invasion and to suppress or avoid the host's immune response (Gotz, 1991).

MATERIALS AND METHODS

Isolation of Beauveria Bassiana

The Fungus was isolated from cadaver of *Inderbella quadrinotata*, (Guava Bark eating caterpillar) larvae collected from guava orchards at Allahabad. The culture was then purified on PDA media and maintained for use in the various experiments.

Preparation of Different Concentration of *Beauveria Bassiana*

B. bassiana were cultivated and maintained on potato dextrose agar (PDA) medium. For conducting various experiments, 2-3 weeks old fungal culture was used. Conidia were harvested by scrapping the surface of culture with a sterile loop in 10 ml distilled water. A drop of 0.01 percent Tween 80 was added to it. The spore suspension was filtered through muslin cloth to removed mycelia and prepared different concentration (1%, 2%, 3%, 4%, 5%, 6%, and 7%) was used.

Collection and Rearing of Insect

The larvae of the pink bollworm were collected from infested cotton field at Allahabad and maintain laboratory culture, field collected larvae were confined to glass jars with filter paper on the bottom, mouth closed with muslin cloth. They were provided with fresh cotton bolls, soybeans leaves and synthetic diet as a food and reared until adult emergence. Adult moths were fed with 10% honey solution by cotton swab soaked inside the jar and fortified with multivitamin and were allowed to lay eggs on top of cotton bolls. The weather conditions that prevailed in the laboratory were maximum temperature 22 ^{0}C to 32 ^{0}C and minimum temperature 8 ^{0}C to 15 ^{0}C and relative humidity 69% to 75%.

Field Bioassay

The observations on mortality percentage of *Pectinospora gossypiella* at 3, 7 and 10 days after treatment at each of the two spraying were recorded.

Growth Inhibition of Larvae

For bioassay, spraying method was adopted. Eight of different spore concentrations of *B. bassiana* were sprayed against *P. gossypiella* larvae. Ten larvae were used per replication. The larvae were treated with sterile distilled water and 0.006 % (v/v) of cypermethrin. These two served as positive control. After treatment, the larvae were allowed to feed on semi-synthetic diet. Each treatment was replicated thrice (**Hafez *et al.* 1994)**.

Growth Inhibition of Pupae

Eight different spore concentrations of *B. bassiana* with three replications each were used for infecting the pupa of *P.gossypiella*, The pupae were sprayed with 1%, 2%, 3%, 4%, 5%, 6%, 7% of respective fungal spore suspensions using

hand atomizer. The pupae were treated with sterile distilled water and 0.006 % (v/v) cypermethrin. These two served as positive control. The growth of surviving pupa was recorded up to adult emergence (**Hafez *et al.*, 1994**)

Adult Longevity, Fecundity and Egg Hatchability

Healthy adults were released into mud pots at 1:1 male female ratios. Cotton swabs dipped in 10% honey treated with 1%, 2%, 3%, 4%, 5%, 6%, and 7% of the test fungi served as treatment. The experiment was performed using eight different spore concentrations of the test fungi, *B.bassiana* and 0.006% Cypermethrin Untreated served as controls. Triplicates were maintained for each treatment and the data were analyzed statistically (Malarvannan, 2004)

Calculate mortality percentage by the use of following formula (Abott 1925):-

$$\text{Mortality (\%)} = \frac{\text{No. of Dead Larvae}}{\text{No. of Released Larvae}} \times 100$$

RESULTS AND DISCUSSIONS

The result represented (Table 1). Field bioassay was conducted with variation between different treatments was significant. In addition, the fungal growth was observed on the larva, which confirms the efficacy of the bio-control agent. The larval mortality was observed 3-7 -10 days after the fungal treatment. With entomophthoralean fungi, unicellular yeast-like cells with chitinous walls (hyphal bodies) spread throughout the insect obtaining nutrients, leading to the death of the host by physiological starvation about 3-7 days after infection Cypermethrin 25% SC was most effective recorded highest per cent mortality of Pink bollworm *i.e*. (59.33), followed by *B. bassiana* 7%(54.03) , *B. bassiana* 6%(49.76), *B. bassiana* 5% (44.95) , *B. bassiana* 4%(40.29), *B. bassiana* 3%(37.93), *B. bassiana* 2%(37.25), *B. bassiana* 1%(31.90) least effective among all the treatments respectively, as compared to control T_0 (14.34).Similarly results were reported with different concentration of *B.baasiansa* (62.98),(60.58)(59.67)(58.32) Ritu *et al*, 2012.

The results presented in (Table 2) *B. bassiana* treated pupae of *Pectinophora gossypiella* compared with the control after 2nd spray. Among the different treatments healthy moth emergence was severely affected in larvae treated with Cypermethrin 25% SC was most effective recorded highest reduction percent of mortality Pink boll worm *i.e*. (72.64), followed by *B. bassiana* 7%(69.42) , *B. bassiana* 6%(69.38) , *B. bassiana* 5% (67.02) , *B. bassiana* 4%(64.02), *B. bassiana* 3%(60.39), *B. bassiana* 2%(58.09), *B. bassiana* 1%(54.34) least effective among all the treatments respectively, as compared control (14.44). Similarly results were reported with different concentration of *B.bassiana* (48.90) and (43.09) Sheetal and Deepak 2011.

Table 1: Effect of *Beauveria bassiana* on Percentage of Mortality Pink Bollworm *Pectinophora gossyipella* after (1st Spray)

Treatment No.	Treatment	Percentage of Mortality Pink Bollworm				
		Pre- Treatment Population	3DAS	7DAS	10DAS	Mean
T_1	*B. bassiana* 1%	3.6	14.53 (22.40)	32.70 (34.86)	48.48 (44.13)	31.90
T_2	*B. bassiana* 2%	4	18.25 (25.36)	40.90 (39.53)	52.62 (46.50)	37.25
T_3	*B. bassiana* 3%	3.8	19.31 (26.06)	41.20 (39.87)	53.30 (46.89)	37.93
T_4	*B. bassiana* 4%	3.2	24.29 (29.52)	42.05 (40.60)	54.54 (47.60)	40.29
T_5	*B. bassiana* 5%	2.4	28.35 (32.17)	47.21 (43.40)	59.31 (50.36)	44.95
T_6	*B. bassiana* 6%	2.4	32.67 (34.85)	53.30 (46.80)	63.32 (52.72)	49.76

Table 1: Contd.,						
T_7	*B. bassiana* 7%	3.2	38.37 (37.68)	56.59 (48.78)	67.13 (55.01)	54.03
T_8	Cypermethrin 25 EC	3.4	46.57 (43.03)	60.29 (50.94)	71.14 (57.51)	59.33
T_0	Control	3.4	11.32 (19.64)	14.31 (22.22)	17.53 (24.74)	14.38
	S.Ed(±)	-	3.42	0.45	0.62	
	C.D.(P= 0.05)	-	1.65	1.13	1.25	

***Figures in parenthesis are arc sin transformed values**

Table 2: Effect of *Beauveria bassiana* on Percentage of Mortality Pink Bollworm *Pectinophora gossypiella* after (2nd Spray)

Treatment No.	Treatment	Percentage of Mortality Pink Bollworm				
		Pre- Treatment Population	3DAS	7DAS	10DAS	Mean
T_1	*B. bassiana* 1%	3.2	50.22 (45.12)	54.63 (47.65)	58.18 (49.71)	54.34
T_2	*B. bassiana* 2%	3	54.93 (47.58)	58.46 (49.87)	60.29 (50.93)	58.09
T_3	*B. bassiana* 3%	2.8	55.33 (48.06)	60.29 (50.94)	65.55 (54.10)	60.39
T_4	*B. bassiana* 4%	2.5	59.35 (50.38)	64.39 (53.36)	68.32 (55.75)	64.02
T_5	*B. bassiana* 5%	2	62.33 (52.14)	66.35 (54.54)	72.40 (57.05)	67.02
T_6	*B. bassiana* 6%	1.8	65.42 (53.98)	69.28 (56.26)	73.45 (58.31)	69.38
T_7	*B. bassiana* 7%	1.4	68.36 (55.77)	72.34 (56.34)	77.24 (58.98)	72.64
T_8	Cypermethrin 25 EC	1	68.47 (55.84)	69.15 (58.27)	70.42 (61.51)	69.34
T_0	Control	3.4	10.38 (18.62)	15.31 (23.03)	17.65 (24.37)	14.44
	S. Ed. (±)	-	0.52	0.37	0.62	
	C. D. (P = 0.05)	-	1.17	0.79	1.30	

***Figures in parenthesis are arc sin transformed values**

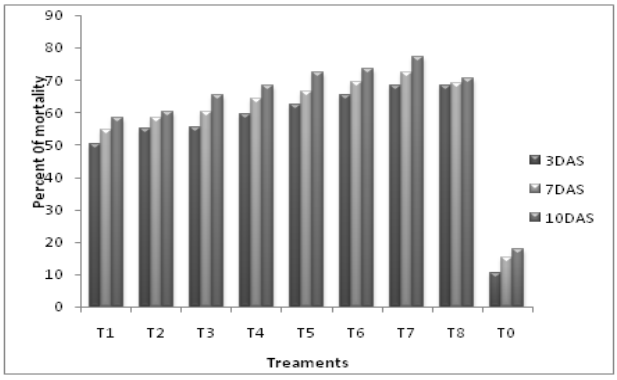

Figure 1: Field Bioassay Conducted with Percentage of Mortality Pink Bollworm

CONCLUSIONS

From the critical analysis of the present findings of "Management of pink bollworm (*Pectinophora* gossypiella Saunder) by bio-agent of *Beauveria bassiana* on cotton crop (*Gossypea hirsutum* L.)" It was concluded that among all treatments Cypermethrin 25 EC @ 0.06% proved to be the best treatment followed by *Beauveria bassiana* 7%, *Beauveria bassiana* 6% and *Beauveria bassiana* 5% in managing *Pectinospora gossypiella* reduction. Therefore, insecticides of short residual effect and *Beauveria bassiana* may be useful in devising proper integrated pest management strategy against Pink bollworm.

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